except in the absence of the definite secondary setæ of the latter. The difference is mainly one of degree. In *Eudeilinea* the setæ have the normal arrangement for the Noctuina, but there are no secondary hairs anywhere above the base of the leg. The seta associated with iii in *Platypteryx* and *Falcaria* is therefore wanting here.

ON THE LARVÆ OF THE HEPIALIDÆ.

PLATES III AND IV.

By A. S. PACKARD.

Of the form and structure of the larvæ of this family very little is known. A brief notice of the egg of *Hepialus argenteomaculatus*, by P. H. Gosse, appeared in his "Canadian Naturalist" (p. 248, 1840). In 1888 Prof. D. S. Kellicott published in Entomologica Americana (iv. p. 153) notes on the larva, which he obtained in abundance in Central New York, from the roots and stems of *Alnus incana*, and showed that the larva probably requires three years to complete its growth. He received the pupa, which disclosed the moth June 2d. In commenting on his paper, Prof. J. B. Smith stated his belief that it lived in the oak, willow and poplar.

In the following year Prof. Kellicott described the mature larva and the pupa, adding further details as to its habits. The eggs are laid the first week in June; the caterpillars live for two years in the roots, and as the third year advances they work upward more or less into the stems; in the spring of the third year they bore out to the surface, partially or loosely plug the opening with chips and transform; pupation occurs about May 1 (in Oswego County, N. Y.), the moths emerging a month later. Mr. Kellicott writes me that he did not preserve either the larva or pupa, of which good figures are much needed. The eggs were not described.

In his note on the habits of *Hepialus thule* (Can. Ent. Vol. xxv, Dec. 1893, p. 297), Mr. H. H. Lyman describes its eggs, of which the enormous number of 2,151 were laid, and this seems to be the first account which we have of any eggs of this family, the works of European authors being apparently defective as regards the habits and life-history of the species of this group. The eggs are said to be "even, oval, slightly flattened on the lower side, perfectly smooth, but dull,

like unglazed porcelain. Color a pale honey-yellow when laid, soon turning black.

Our common Hepialus, *H. mustelinus*, is not uncommon at Brunswick, Maine, resting on the trunks of spruce trees in July. The trees are thickly placed and ferns grow under them. I suspect that they live in the spruce, rather than in the roots of ferns, but have no reason for this opinion. I captured a female in my stable, situated among the spruces, boxed her, and a day after, on the 26th of July, she was kind enough to lay several hundred eggs which I did not count. They were fortunately fertilized, and the young hatched out from them a week or two later; I did not make a note of the exact date.

Egg.—The eggs are very peculiar in appearance, quite different from those of any other moth. They are small, black, shining like seeds. They are about one-half a millemeter in length, the diameter a little less, as the eggs are cylindrical-spherical, slightly pointed at each end. The shell is jet black, highly polished, and under a half-inch objective shows no traces of ornamentation.

Freshly-hatched larva.—(Pl. III, Fig. 1.) Length 1.3 mm. Head large, broad and flattened, somewhat wider than the body and very pale chitinous. Prothoracic segment as wide as the head and with a large dorsal chitinous plate of the same color as the head. The 2d and 3d thoracic segments have no plates. The body is moderately wide, a little flattened and pale whitish, with no markings, and gradually and slightly tapers toward the end. The spinneret is unusually large and long, and the maxillæ are rather large. The thoracic legs are testaceous (chitinous), of the same hue as the head. The abdominal legs are rather long, pale. The hairs are arranged as in Pl. III, Fig. 1 to (A, part of the head, and the succeeding four segments; and B, the last four abdominal segments) in the same way as in normal Tineid and Tortricid larvæ; the four dorsal hairs arising from minute warts arranged in a low or short trapezoid; the terminal segment bearing six setæ. The hairs or setæ are about as long as the segments are broad, becoming longer in proportion on the last segment. They taper towards the end, not assuming the shape of the glandular hairs of the more modern Lepidoptera.

In the fully grown Hepialus larva the setæ are much reduced in size and length. It may be of interest to state that some eggs of the Australian *Oncopera intricata* Walk., kindly sent me by Mr. G. Lyell, jr., are the same in size and appearance. The freshly hatched larvæ are also very similar to those of *Hepialus mustelinus*, the hairs and shape and size of the body being nearly identical.

In the absence of any figure of a native form, I insert camera drawings of two common European species* to show that while they do not differ much in shape, they vary much in the size of the flattened tubercles or chitinous plates from which the setæ arise.

Pl. IV, Fig. 1, represents a dorsal view of the European *Hepialus humuli*.

Pl. IV, Fig. 2, A side view of the same specimen. It will be seen that the prothoracic plate is rather large, while the setiferous tubercles on the second thoracic segment are of the same size as those of the abdominal segments, but those of the second row on the third thoracic segment are about twice as large. This seems a simpler form than the next species figured, as the flattened tubercles give rise to but a single hair.

In the second species, *Hepialus hectus* (Pl. IV, Figs. 3 and 4), there is a considerable amount of divergence from the simple, primitive form of *H. humuli*. On the second and third thoracic plate there is a medium dorsal plate bearing four setæ, and behind on each side a large sub-dorsal plate bearing three short setæ. On the abdominal segments 1–8 are four dorsal setæ and three lateral setæ, arranged as represented in the figure, one being situated above the small spiracle and two behind. The segments are subdivided into four wrinkles, more or less indistinct in the blown specimens which are stretched out abnormally.

Pl. III, Fig. 4. I also add a figure of the front of the head of the pupa of *Hepialus humuli*, which with that of *Œnetus virescens* from New Zealand, I owe to the kindness of Dr. T. Algernon Chapman. The structure of the head is very peculiar. On the vertex are prominent callosities, giving strength to the head in breaking out of the cell. The eye is large, divided by a distinct line, the outer side of the eye more or less corrugated. Directly under the eye are the large triangular maxillary palpi (*mx p*). The maxillæ themselves are short, but not shown in the figure. The clypeal region is narrow, with tubercles and rugosities; the labrum is scarcely differentiated from the front edge of the clypeus, but is slightly bilobate on the base. On each side are what I call the paraclypeal pieces or sclerites (*p*), of the homology of which I am not sure, unless they are identical with the tubercles seen in most Lepidoptera on each side of the labrum, and formerly re-

* For blown specimens of these and other lep dopterous larvæ, as well as pupæ and cocoons, I am indebted to the generosity of my friend, Dr. Otto Staudinger, of Blasewitz, Dresden, Germany, who kindly selected them from his immense collection of blown larvæ and other Lepidoptera.

garded as the mandibles. It is present, though small and reduced in *Hepialus*. The labial palpi (*mx'* *p*) are large and wide, and divided at the end.

Pl. III, Fig. 3, represents the head of *Œnetus virescens* Doubleday. The paraclypeal pieces are not differentiated; while the labrum appears to be slightly distinct from the clypeus, and excavated in the middle of the front edge, the labial palpi (*mx'* *p*) are very short; the maxillary palpi are as in *Hepialus*.

The under side of the end of the body of this pupa, including abdominal segments 8 to 10, is represented by Pl. III, Fig. 2; on the eighth segment is the well developed toothed ridge, while each side of the segment is irregularly dentate. On the ninth segment (IX) are the rudiments of the male genital opening of the moth, a longitudinal scar situated between the usual two tubercles, while the vestiges of the anal legs of the larva (*a. l.*) are represented by the longitudinal flattened tubercles enclosing the scar or vestige of the anus.

Dr. Chapman (Trans. Ent. Soc. London, March, 1893), has from the pupal characters shown that the Hepialidæ should be associated with the Tineina in his division of *Pupæ incompletæ*; shortly after, in the same year, Prof. Comstock (Evolution and Taxonomy) concluded from a study of the venation that the group should be placed at the very bottom of the Lepidopterous series, and Mr. Dyar (Ann. N. Y. Acad. Sc. VIII, 1894, p. 197) agreed with Comstock's view from the examination of a sketch of an European larva (*H. lupulinus*). From a somewhat extended study of the larval, pupal, and also the imaginal characters (thorax and head), including the pupa of *Phassus*, I think there is little doubt but that the Hepialidæ are colossal Tineoids, with the essential features of Tinea and its allies, but yet somewhat modified in adaptation to their boring life. They do not seem to be the most generalized Tineina, being more specialized and later to appear than the Micropterygidæ, and also the Eriocephalidæ.

EXPLANATION OF PLATES.

PLATE III.

Fig. 1. Hepialus mustelinus.—Freshly hatched larva; A, thoracic segments; B, terminal abdominal segments.

Fig. 2. Hepialus humuli.—End of body of pupa; *a. l.* anal legs; IX, male genital organs.

Fig. 3. Œnetus virescens.—Head of pupa; *mx.p*, maxillary palpi; *mx'.p*, labial palpi.

Fig. 4. Hepialus humuli.—Head of pupa; *mxp*, maxillary palpi; *mx'p*, labial palpi; *p*, paraclypeal piece.

PLATE IV.

Fig. 1. Hepialus humuli.—Side view of larva.
Fig. 2. Hepialus humuli.—Dorsal view of larva.
Fig. 3. Hepialus hectus.—Side view of larva.
Fig. 4. Hepialus hectus.—Dorsal view of larva.

PRELIMINARY HAND-BOOK OF THE COLEOPTERA OF NORTH EASTERN AMERICA.

By CHARLES W. LENG AND WM. BEUTENMULLER.

(Continued from Vol. II, p. 190.)

HARPALINÆ.

The members of this sub-family have the middle coxal cavities entirely closed by the central pieces of the meso and metasternum, the epimera not attaining the coxa. Head with setigerous puncture over the eyes. Thorax with setigerous puncture at the side and posterior angle, very rarely without the latter and still more rarely without either. Anterior tibiæ always either obliquely sinuate or deeply emarginate within, the inner spur remote from the apex. They may be divided into two sections, Harpalinæ bisetosæ, head with two-supra-orbital setigerous punctures, and Harpalinæ unisetosæ, which have the head with one supra-orbital setigerous puncture. The former contain all the genera from *Panagæus* to *Helluomorpha* inclusive, and the latter from *Brachynus* to *Anisodactylus* inclusive.

Panagæus *Lat.*

Head more or less constricted behind the eyes and dilated to a semi-globular neck; clypeus prolonged beyond the base of mandibles, which are scissor-like; antennæ arising from under a distinct frontal ridge, three basal joints glabrous; terminal joint of maxillary palpi arising obliquely from the preceding joint; sides of elytra narrowly inflexed; thorax globular, abruptly constricted behind. Found under stones during May and June.

Synopsis of Species.

Elytra black with two large red spots extending from the margin to the first or second striæ,.....**crucigerus**
Elytra red with a transverse black band behind the middle and another at the tip,
.....**fasciatus**